

What is claimed is:

1. A method of inspecting a continuously moving web, comprising:
5 a) imaging a sequential portion of the continuously moving web to provide a digital data stream,
 b) forming a blob list from the data stream, and
 c) analyzing blobs on the blob list to identify defects, wherein b) and c) occur in a single computer.

10 2. A method according to claim 1, further comprising binarizing said digital data stream prior to forming said blob list.

15 3. A method according to claim 2, wherein the digital data stream corresponding to each sequential portion describes pixels in an X domain corresponding to their position across the web, and wherein the forming step comprises

20 determining collections of pixels connected to each other in the X domain so as to define segments;

 resolving line to line whether connections exist between segments in a Y domain corresponding to the direction of web movement; wherein

25 the determining step and the resolving step are accomplished in a single iteration.

4. A method according to claim 3, further comprises saving in turn a list of the segments in each sequential line as a comparison list, and wherein

25 the resolving comprises comparing the segment list for the current line with the comparison list.

5. The method according to claim 1, wherein the web is a patterned web, and further comprising binarizing the digital data stream, the binarizing comprising
- identifying at least one sequential portion having substantially the entire range of optical properties characteristic of the web;
- 5 identifying the pixel values corresponding to local maxima and minima;
- defining a range bounded by the lowest value among the pixel values identified as local maxima and the highest value among the pixel values identified as local minima;
 - calculating a threshold value within the range; and
 - comparing at least a portion of the digital data stream to the threshold value.
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6. A method according to claim 1, wherein a filter is applied to the data stream in the single computer prior to forming the blob list.
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7. A method according to claim 1, further comprising communicating between the single computer and a process control system.
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8. A method according to claim 1, further comprising marking identified defects on the continuously moving web.
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9. A method according to claim 8, wherein said marking occurs through ink deposition, paint deposition, laser tagging, label application, hole punching, physical deformation, magnetic pulsing or combinations thereof.
10. A method according to claim 8, wherein said marking occurs substantially near the point of occurrence of the defect.
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11. A method according to claim 1, wherein said web is selected from metals, paper, polymeric films, wovens, non-wovens, glass or combinations thereof.
12. A method according to claim 11, wherein one or more coatings or one or more patterns are applied to said web.

13. A method according to claim 12, wherein said continuously moving web is a flexible circuit web.
- 5 14. A method according to claim 1, wherein said imaging occurs through reflected light, transmitted light or transreflected light.
- 10 15. A method according to claim 1, wherein multiple imaging sources are utilized.
16. A method according to claim 2, wherein said binarizing includes adaptive thresholding or multiple value thresholding.
- 15 17. A method according to claim 1, wherein said data stream is at least 10 mega-pixels/second.
18. A method according to claim 1, further comprising classifying defects into specific categories.
- 20 19. A method of inspecting continuously moving articles on a web, comprising analyzing blobs formed from a continuous digital data stream of at least 10 mega-pixels/second imaged from at least a portion of a continuously moving article to identify defects on the articles, wherein the blobs are formed and analyzed in a single computer.
- 25 20. A method for inspecting continuously moving webs having a repeating pattern, the method comprising:
- imaging sequential portions of the continuously moving web to provide a digital data stream,
 - identifying instances of the repeating pattern,
 - forming a blob list representative of each instance of the repeating pattern from the data stream, and
 - analyzing blobs on the blob list to identify defects, wherein c) and d) occur in a single computer.
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21. A method according to 20, wherein the number of blobs on the blob list for each instance of the repeating pattern is compared against a predetermined number.
- 5 22. A method according to 20, wherein positional and geometric properties of each blob is compared against a corresponding blob in a reference blob list.
- 10 23. A method according to 20, wherein
- the digital data stream corresponding to each sequential portion describes pixels in an X domain corresponding to their position across the web, and wherein
- the blob list includes information on the lengths of collections of pixels connected to each other in the X domain; and further wherein the analyzing step comprises
- calculating information on the lengths of collections of pixels connected to each other in a Y domain corresponding to the direction of web movement;
- modifying the lengths of the collections of pixels in at least one of the X domain, the Y domain, or both domains, by a first predetermined number;
- preparing a new blob list based on the modified lengths; and
- comparing the number of blobs on the new blob list against a second predetermined number.
- 20 24. A method according to 20, wherein said imaging occurs through reflected light, transmitted light or transflected light.
- 25 25. A method according to claim 20, wherein the data stream is utilized to find individual patterns on said web without external synchronization.
- 30 26. A method according to claim 20, further comprising binarizing of said digital data stream prior to forming said blob list.
27. A method according to claim 26, wherein said binarizing occurs using adaptive thresholding or multiple value thresholding.

28. A method according to claim 20, wherein said continuously moving web is a flexible circuit web.

5 29. A method according to claim 28, wherein said defects include one or more of shorts, opens, lead reductions, space reductions, substrate defects, pattern misregistration, bent leads, covercoat defects, lamination defects, stains, or debris.

10 30. A method according to claim 20, further comprising marking one or more defects on said continuously moving web.

15 31. A method according to claim 30, wherein said marking occurs substantially near the point of occurrence of the defect.

20 32. A method according to claim 20, wherein said single computer communicates with a process control system for controlling said continuously moving web.

25 33. A method according to claim 20, wherein said imaging device is spatially synchronized to the continuously moving web.

30 34. A method according to claim 20, wherein multiple imaging sources are utilized.

36. A device for inspecting a continuously moving web, comprising

- (a) An imaging device for sequentially imaging a portion of a continuously moving web to provide a digital data stream; and
- (b) A single computer capable of forming a blob list from the data stream and analyzing the blob list in order to identify defects in at least a portion of said continuously moving web.

37. A device according to claim 36, further comprising a process control system in communication with the single computer.

5 38. A device according to claim 36, further comprising a marking system for marking identified defects on the continuously moving web.

39. A device according to claim 36, wherein said image device is a line scan camera.

10 40. A device according to claim 36, wherein said imaging device utilizes optical assemblies which utilize reflected light, transmitted light or transflected light.

41. A device according to claim 36, wherein multiple imaging devices are utilized.

15 42. A device for inspecting flexible circuits, comprising

- (a) An imaging device for sequentially imaging a portion of a continuously moving flexible circuit web to provide a digital data stream; and
- (b) A single computer capable of forming a blob list from the data stream and analyzing the blob list in order to identify defects in at least a portion of said continuously moving flexible circuit web.

20 43. A device according to claim 42, further comprising a process control system for communicating between the single computer and the process control system.

25 44. A device according to claim 42, further comprising a marking system for marking identified defects on the continuously moving web.

45. A device according to claim 42, wherein said image device is a line scan camera.

30 46. A device according to claim 42, wherein said imaging device utilizes optical assemblies which utilize reflected light, transmitted light or transflected light.

47. A device according to claim 42, wherein multiple imaging devices are utilized.

48. A method of inspecting a flexible circuit web, comprising analyzing blobs formed from a continuous digital data stream of at least 10 mega-pixels/second imaged from at least a portion of a flexible circuit web to identify defects on the flexible circuit web,
5 wherein the blobs are formed and analyzed in a single computer.